# Appendix G

# BIOLOGICAL EVALUATION

for

Threatened, Endangered, and Sensitive (TES) Fish Species

## Blue Mountain Ranger District
## Malheur National Forest

## Flagtail Fire Restoration Project

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## SUMMARY

The following table displays the threatened, endangered and sensitive (TES) fish species present on the Malheur National Forest. Only species with a documented occurrence, redband trout and Malheur mottled sculpin, were considered in the analysis of the Flagtail Fire Restoration project and the effects of the alternatives.

| Aquatic Species | Scientific Name | Status | Occurrence |
|---|---|---|---|
| Interior Redband Trout | *Oncorhynchus mykiss* ssp. | S | D |
| Malheur mottled sculpin | *Cottus bendirei* | S | D |
| Columbia River Bull Trout | *Salvelinus confluentus* | T | N |
| Mid-Columbia River Steelhead[1] | *Oncorhynchus mykiss* ssp. | T | N |
| Mid-Columbia River Spring Run Chinook Salmon | *Oncorhynchus tshawytschaw* | S | N |
| Chinook Salmon[2] | *Oncorhynchus tshawytschaw* | MS | N |
| West Slope Cutthroat Trout | *Oncorhynchus clarki lewisi* | S | N |

### Status

| | |
|---|---|
| E | Federally Endangered |
| T | Federally Threatened |
| S | Sensitive species from Regional Forester's list |
| C | Candidate species under Endangered Species Act |
| MS | Magnuson-Stevens Act designated Essential Fish Habitat |

### Occurrence

| | |
|---|---|
| HD | **Habitat Documented** or suspected within the project area or near enough to be impacted by project activities |
| HN | **Habitat Not** within the project area or affected by its activities |
| D | Species **Documented** in general vicinity of project activities |
| S | Species **Suspected** in general vicinity of project activities |
| N | Species **Not documented** and not suspected in general vicinity of project activities |

### Effects Determinations

| Species | Effects Determination* Alternative 1 No Action | Effects Determination* Alternative 2 Proposed Action | Effects Determination* Alternative 3 Proposed Action | Effects Determination* Alternative 4 Proposed Action |
|---|---|---|---|---|
| **Aquatic Species** | | | | |
| Interior redband trout | **MIIH** | **MIIH (BI)** | **MIIH (BI)** | **MIIH (BI)** |
| Malheur mottled sculpin | **MIIH** | **MIIH (BI)** | **MIIH (BI)** | **MIIH (BI)** |

*Effects in Parentheses are Long Term Effects if different from Short Term Effects

### Sensitive Species Determinations

| | |
|---|---|
| **NI** | No Impact |
| **MIIH** | May Impact Individuals or Habitat, but Will Not Likely Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species |
| **WIFV** | Will Impact Individuals or Habitat with a Consequence that the Action May Contribute to a Trend Towards Federal Listing or Cause a Loss of Viability to the Population or Species |
| **BI** | Beneficial Impact |

## INTRODUCTION

This Biological Evaluation (BE) analyzes the potential effects of the proposed action and alternatives. This BE satisfies the requirements of Forest Service Manual 2672.4 that requires the Forest Service to review all planned, funded, executed or permitted programs and activities for possible effects on proposed, endangered, threatened or sensitive species.

This Biological Evaluation (BE) documents the review and findings of Forest Service planned programs and activities for possible effects on species (1) listed or proposed for listing by the USDI Fish and Wildlife Service (USFWS) and by the National Marine Fishery Service (NMFS) as Endangered or Threatened; or (2) designated by the Pacific Northwest Regional Forester as Sensitive. It is prepared in compliance with the requirements of Forest Service Manual (FSM) 2630.3, FSM 2672.4, FSM 10.89 R-6 Supplement 47 2670.44, and the Endangered Species Act (ESA) of 1973 (Subpart B; 402.12, Section 7 Consultation).

Proposed, Endangered, Threatened, or Sensitive species considered in this evaluation are those listed in FSM 2670.44, R-6 Interim Directive No. 90-1, March, 1989 as suspected or documented to occur on the Malheur National Forest's Blue Mountain Ranger District.

### Species Considered in this Assessment

The following sources of information have been reviewed to determine if PETS (proposed, endangered, threatened, or sensitive) species and their associated habitats may or may not occur within the project area:

- Regional Forester's Sensitive Species List
- Forest sensitive species database and the current GIS mapping layers
- Oregon Natural Heritage Program Data Base records
- Project area maps, unique habitat data bases, and any historical records
- Current Regulatory Agency status reports and listed species new releases

Habitats for proposed, endangered, threatened, or sensitive species (PETS) are identified by correlating the physical and biological features found in the project planning area with habitat features in which PETS species are known or suspected to occur. All aquatic Management Indicator Species (MIS) on the Blue Mountain Ranger District of the Malheur National Forest are currently listed as threatened or sensitive. Therefore, MIS species would not be discussed as a separate topic.

## EFFECTS ANALYSIS

### Aquatic Species

### Species Considered in this Assessment

All Management Indicator Species (MIS) of fish on the Blue Mountain Ranger District of the Malheur National Forest are currently listed as sensitive. Therefore, MIS species will not be discussed as a separate topic.

Columbia basin bull trout (*Salvelinus confluentus*), Mid-Columbia summer steelhead (*Oncorhynchus mykiss*), Mid-Columbia River spring Chinook (*Oncorhynchus tshawytscha*), and westslope cutthroat trout (*Oncorhynchus clarki lewisi*) are not present in the project area or anywhere in the Silvies Subbasin and do not have habitat in the project area; therefore, these species will not be discussed further in this BE.

**Interior Redband Trout (*Oncorhynchus mykiss gairdneri*)**
**Status: USFS Region 6 Sensitive**
Heritage Status – Global Conservation Status Rank: G5 (25 Sept 1996)
**Rounded Global Conservation Rank: T4**
American Fisheries Society Status: Special Concern

Global Conservation Status Rank Reasons:
Still widespread in interior western North America but with local declines and extirpations. The global range includes the Columbia River basin east of the Cascades to barrier falls on the Kootenay, Pend Oreille, Spokane, and Snake Rivers; the upper Frazier River basin above Hell's Gate; and Athabasca headwaters of the Mackenzie River basin, where headwater transfers evidently occurred from the upper Frazier River system (Benke 1992). In the Columbia River basin, nearly all upriver and many lower river stocks appear to be improving after having declined (Nehlsen et al. 1991). Many stocks in the Columbia River basin are, however, threatened by mainstem passage problems, habitat damage (due to logging, road construction, mining, and grazing, which decrease water quality and increase siltation), and interactions with hatchery fishes (Nehlsen et al. 1991).

Environmental Baseline
There are four different populations of redband trout in the Blue Mountains. These are: 1) sympatric populations with steelhead, 2) isolated allopatric populations in anadromous watersheds, 3) allopatric populations in the Great Basin portion of the Blue Mountains, and 4) allopatric populations in watersheds that formally supported anadromous populations (N.F. Malheur and Upper Malheur Rivers). There is little data on current population trends of the redband trout; however, the four population types do not face the same level of threats from management activities. Subpopulations of the Great Basin redband trout are probably at the greatest threat of being listed as threatened under the ESA. These fish are located in Trout Creek, a tributary to the Silvies River. Redband trout in the project area are of the Great Basin population. Overall, the Interior redband trout have the most extensive area of all game fishes in the Blue Mountains. They are in the smallest headwater areas as well as in the largest rivers of the Blue Mountains.

**Table 1. Redband Bearing Streams in The Project Area (Total for Forest Service Lands by subwatershed in Parentheses)**

| Subwatershed | Redband Fish Bearing Miles | Habitat Type | Perennial Non-fish Bearing Miles | Intermittent/Seasonal Miles |
|---|---|---|---|---|
| Hog Creek* | 0 (4.6) | Rearing, Spawning | 0 (7.5) | 0 (10.5) |
| Snow Creek* | 6.5 (15.7) | Rearing, Spawning | 2.4 (2.5) | 5.2 (11.1) |
| Keller Creek | 0 (9.3) | Rearing, Spawning | 0.2 (7.5) | 0 (15.0) |
| Jack Creek | 0.9 (6.3) | Rearing, Spawning | 1.5 (12.4) | 4.2 (23.9) |
| Total | 7.4 (35.8) | Rearing, Spawning | 4.1 (29.9) | 9.4 (60.4) |

*Not true subwatersheds, includes segments of the Silvies River

Native trout found in the internal basins of Oregon are redband trout derived from the Columbia River system. Malheur Lake Basin is the largest of the Oregon desert basins and contains the greatest amount of trout habitat. The Silvies River is one of six sub-basins feeding into the lake. Basin fish fauna show little difference from the Columbia River fauna, suggesting a rather broad and geologically recent connection between Malheur Lake and Malheur River; which flows east into the Snake River system. Berg (1987) found a relatively high frequency in genetic likeness between the Silvies River and the

Columbia River sub-groups. J.O. Snyder was the first researcher to sample Malheur redband trout in 1904, taking them from the Silvies River and Silver Creek.

It is not known if pure native trout populations exist in the Malheur basin (Behnke 1992). The last specimen collected that was thought to be pure native came from Smyth Creek in 1968. Hatchery introduction has occurred across the basin in years past and native redband trout face constant hazards in the high desert environment. The Flagtail Project Area's climatic extremes of high summer temperatures and low flow conditions frequently produce oxygen depletion in the water. Malheur redband trout are a genotypic sub-species adapted to these unstable, harsh, environments and because they are more adapted to variable water conditions, they probably have resisted hybridization with hatchery fish or native cutthroat. Observations in the Silvies watershed have verified this adaptive nature by finding redband trout in some very marginal waters late in the summer. They tend to be small in size and are better suited for the microhabitats being maintained by base flows of less the 0.3 cubic feet per second. Hatchery rainbows would not be able to tolerate the harsh water conditions.

Interior redband trout, on the Region 6 Sensitive Species List, are assumed to be the resident form of the anadromous steelhead. Most redband trout spawning and rearing occurs in the second to fourth order streams in the forested environment. Even when small streams are not accessible to migrating fish because of barriers or steep gradients, they are vitally important to the quality of downstream habitats.

**Malheur mottled sculpin (*Cottus bendirei*)**
**Status: USFS Region 6 Sensitive**
Heritage Status – Global Conservation Status Rank: G5T3Q (August 28, 1996)

- National Rank=N3 (Dec 05, 1996)
- Oregon State Rank=S3
- **Federal Status:** Species of Concern (list 1-7-00-SP-588).

The Upper Silvies WA (2001) states that Malheur mottled sculpin was originally collected in Rattlesnake Creek in Harney County with other similar samples found in Silver Creek, and Lower Silvies River with studies conducted in 1963 and 1971.

The current taxa wisdom for the Malheur mottled sculpin is a smooth-skinned (non-prickled), reduced lateral line form, of the predominately prickled subspecies *Cottus semiscaber*; now thought to be broadly distributed in the western U.S. with both smooth and prickled forms. Lower Silvies River samples collected form 1955-1968 showed similar characteristics to the Snake River form for completeness more than the Harney Basin form. Pectoral and pelvic fin ray numbers were also higher between the two groups; predominately because the pelvic fin in the Silvies group showed three rays while the Harney Basin group showed four.

At the local watershed level, this analysis simply recognizes both sub-forms of *Cottus bairdi* in the Silvies River. The Scotty Creek samples (1997) and perhaps the rest of the watershed favor *bendirei* while the lower Silvies River samples (1955-1968) favored *hubbsi*. Peden et. al. (1989) suggests that a closer look at *Cottus bairdi* character points is needed in terms of their relationship to habitat and stream variants and the linkage issue of possible hybridization with other sculpin. The more recent and dramatic shift in the Silvies River composition between upper and lower river groups could indicate an active fluctuation in one of the two coexisting forms or a slow evolution of the two forms into one new polymorphic form. More taxonomic work is needed to identify the subtle differences and possible changes in the two subspecies across Bear Valley.

Mottled sculpin require water temperatures below 26°C with high dissolved oxygen and low turbidity. They are found in streams with moderate to rapid current and are associated with rubble, gravel, or rocky bottoms. They seldom are found in silted areas. Malheur mottled sculpins are sensitive to changes in water quality including increases in water temperature and sediment. Spawning occurs in the spring generally from February through May. Females deposit adhesive eggs in a crevice or under rocks in clusters of 20 to 150. The male guides her to the nest area and guards the nest after she leaves the area. The female produces from about 50 to 300 eggs, depending on her size. Eggs hatch in about 4 weeks. They feed on a variety of aquatic invertebrates, mostly insects, but also shrimp, snails, fish eggs and fish fry. They were thought to be serious predators of trout eggs and fry, but results of studies on their food habits have revealed that few trout eggs or fry are actually eaten. Mottled sculpins are much more important as forage for trout.

Environmental Baseline

Malheur mottled sculpin have been confirmed and documented by Forest Service or Oregon Department of Fish and Wildlife surveys as occupying the Silvies River in the project area as well as the Silvies River and Hog Creek upstream from the project area (USDA Forest Service 2001). Sculpin are a bottom dwelling fish that generally favor streams dominated by riffles or glides with cool water and clean, silt free, gravels, although the "*bairdi*" complex can tolerate temperatures up to 70 degrees F. Many of the streams within the project area do not meet the preferred habitat conditions; therefore, water temperature is more likely a key factor in structuring and controlling seasonal distribution patterns.

**Table 2. Malheur Mottled Sculpin Bearing Streams in Analysis Area (Total for Forest Service Lands by subwatershed in Parentheses)**

| Subwatershed | Malheur mottled sculpin Fish Bearing Miles | Habitat Type | Perennial Non-fish Bearing Miles | Intermittent/Seasonal Miles |
|---|---|---|---|---|
| Hog Creek* | 0 (4.6) | Rearing, Spawning | 0 (7.5) | 0 (10.5) |
| Snow Creek* | 3.5 (13.4) | Rearing, Spawning | 2.4 (2.5) | 5.2 (11.1) |
| Total | 3.5 (18.0) | Spawning, Rearing | 2.4 (10.0) | 5.2 (21.6) |

*Not true subwatersheds, includes segments of the Silvies River

## PROJECT LOCATION

In July 2002, the Flagtail Fire burned approximately 8,200 acres, of which 7,200 are located on the Malheur National Forest in the Blue Mountain Ranger District. The Flagtail Fire Recovery Project area consists of these 7,200 acres, located within the Upper Silvies Watershed, approximately 25 miles southwest of John Day, Oregon. Figure 1 displays the project area in relation to the state of Oregon and the Malheur National Forest. Project activities would occur in Snow Creek, Keller Creek, Hog Creek and Jack Creek subwatersheds.

### Existing Conditions of Aquatic Habitat

The Silvies River, Snow Creek, Hog Creek and Jack Creek contain summer/winter rearing and spawning habitat for redband trout. The Silvies River and a segment of Hog Creek contain summer/winter rearing and spawning habitat used by Malheur mottled sculpin; however, the fish-bearing portion of Hog Creek is outside the project area.

The Silvies River (25 miles downstream of the project area) and Snow Creek are on the state of Oregon 303(d) List for water quality concerns; they are listed for excessive summer rearing temperature for fish.

The table below displays habitat features documented during Level II Stream conducted by Malheur National Forest Personnel. The table also lists Malheur National Forest Long Range Management Plan (LRMP) Standards.

**Table 3: Level 2 Stream Survey Results and LRMP Standards**

| Stream Name and Survey Reach | Existing LWD♠ Per Mile | LRMP Standard (LWD Per Mile) | Existing Pools/Mi. | LRMP Standard Pools/Mi. | Existing Bank Stability | LRMP Standard Bank Stability |
|---|---|---|---|---|---|---|
| Silvies River R1 | 5.7 | 20-70 | 59 | 75-132 | 90 | 80% |
| Silvies River R2 | 0.6 | 20-70 | 65 | 75-132 | 79 | 80% |
| Silvies River R3 | 0.0 | 20-70 | 16 | 75-132 | 99 | 80% |
| Jack Cr. R3 | 3.2 | 20-70 | 39 | 151-264 | 100 | 80% |
| Jack Cr. R4 | 8.7 | 20-70 | 55 | 151-264 | 99 | 80% |
| Snow Cr. R1 | 5 | 20-70 | 78 | 75-132 | 96 | 80% |
| Snow Cr. R2 | 15 | 20-70 | 86 | 75-132 | 97 | 80% |
| Keller Cr. | 17 | 20-70 | 151 | 75-132 | 98 | 80% |

♠ LWD includes both large and medium woody debris which is effective in smaller streams

## Information Important to this Analysis

Categorical Exclusions

Several projects in the Flagtail Project Area will be completed under Categorical Exclusions. Implementation of these projects will begin in spring of 2003 and include:

1. Placement of large or coarse wood (LWD) in Category 1-4 streams and ephemeral draws. The table below lists miles of Category 1-4 streams where this would occur. This placement would bring pieces of wood up to the minimum of 20 pieces per mile standard listed in the MNF LRMP. While the size does not meet the minimum listed in the Forest Plan, it would be appropriate for the smaller streams located in the project area. Aggregates of 2 or more pieces may be used in some locations.
2. Riparian hardwood planting and protection in Category 1 and 2 streams. Activities would include planting clumps or individual cuttings or bare root plants on stream banks within 5 feet of the channel in the project area. The table below lists miles of perennial and fish bearing streams where this would occur.

**Table 4. Placement of Woody Debris and riparian hardwood planting**

| Stream | LWD Placement | | Plant Hardwoods | |
|---|---|---|---|---|
| | Miles | Pieces | Miles | Plants |
| Snow | 2.3 | 70 | 0.8 | 850 |
| Trib 1 | 0.3 | [buck existing from Hazard tree felling] | 0.5 | 500 |
| Silvies | 4.5 | 135 | 4.5 | 4800 |
| Jack | 0.9 | 72 | 0.5 | 500 |
| Swamp | 0.1 | 5 | | |

3. RHCA and upland conifer planting. Conifers were planted on 186 acres on the outer portion of the 300 foot RHCA (not the riparian area) of the Silvies River and Snow Creek as well as 194 acres of uplands in spring 2003.

4. A fuels reduction project is planned for inside RHCAs where some dead, submerchantable trees (less than 8-inch DBH) would be thinned to reduce fuel levels, then used for other CE projects (aspen buck and pole fences or LWD) or handpiled and burned outside of riparian areas.
5. Fences are planned to be built around numerous aspen clones in the Flagtail fire area to protect saplings and small trees from wild and domestic ungulate browsing.

Livestock Grazing

No grazing would occur in the Flagtail Fire Area for a minimum of 2 years to allow riparian and upland herbaceous vegetation and hardwood shrubs to recover from effects of the fire. When re-initiated, grazing by domestic livestock would be maintained within Forest Plan and Interagency Interdisciplinary Team (IIT) standards.

Sediment Transport

A study of sediment transport from roads was conducted prior to the fire and was described in the Upper Silvies Watershed Analysis Appendix D (USDA 2001). The summary of key points from this study is as follows:

1. Sediment rarely moved farther than 32 feet (slope distance) from the road prism. Sediment traveled 65 feet after moving off the road prism but this was only 32 feet from the road. The ninetieth percentile for sediment travel is 50 feet or less. A very small amount of sediment (probably 0.01 $yd^3$) moved 50 feet after leaving the road. There were 2 instances where sediment traveled more than 100 feet off roads. One was where water funneled onto an abandoned road and the other where the disturbance was located on a "scab" (a non-forest area with shallow soils and limited ground cover).
2. Main control of sediment was by filtering though grasses, elk sedge and other herbaceous plants and from water moving subsurface due to high water infiltration rates (McNeil 2001).
3. Buffer widths of 50 feet or less are sufficient to protect streams from sediment caused by existing roads, except near scabs.
4. There is limited precision of GIS mapped locations of roads and streams on the Malheur National Forest layers. Using 100-foot (mapped GIS) distance as an indicator for roads likely impacting streams will adjust for mapping error. Distances of harvest/fuels treatment units were measured in the field and are therefore accurate.

The fire may have removed herbaceous vegetation above the soil in some areas but it is highly unlikely that the fire killed any appreciable amounts in riparian areas. Fisheries personnel observed herbaceous vegetation recovery during field surveys in the fall following the fire. Complete recovery of herbaceous vegetation in uplands is expected by 2007 (see soils report). Recovery in riparian areas will likely occur even faster due to the greater availability of water (duration and magnitude) for growth, and lower fire intensity in most riparian areas. Monitoring information from the Summit fire showed that recovery of the filtering capacity was sufficient to reduce sediment created from skid trails that reaches streams to negligible amounts.

The Flagtail BAER report noted that infiltration rates might have been reduced on up to 575 acres in the Flagtail Project Area due to hydrophobicity, or water repellency, caused by high severity fire on ash soils. These impacts are expected to diminish within 22 months after the fire.

## Sediment Transport Modeling for Runoff Events

The Water Erosion Prediction Program (WEPP) was used to predict sediment transport to streams from various runoff events. Sediment transport decreases with time after ground disturbing activities such as

fire (see Soils and Watershed sections). For this analysis Year 2 after the fire (2004) was used to compare all alternatives. Pre-fire sediment rates were 0.01 tons/acre. Post-fire runoff rates, modeled for Year 2, ranged from 0.01-0.4 tons/acre depending on slope and fire severity. Management activities increased rates by 0.04-0.07 tons/acre for tractor logging (depending on mitigation measures), 0.02 tons/acre for skyline, while helicopter activities did not increase sediment transport rates.

WEPP was used to predict sediment transport for high probability runoff events, which were considered to be less than 5-year events. WEPP modeling (see Soils and Watershed sections) determined that no measurable levels of sediment would reach fish-bearing streams from all alternatives. The project hydrologist and fishery biologist conducted field monitoring in 2003, in which only high probability runoff events occurred, and found no sediment movement on hillslopes in the project area which supports the findings of the WEPP model.

WEPP was also used to predict sediment transport for low probability runoff events, which were determined to be 5-year or greater events. The WEPP model predicted a potential 11 to 15-fold increase in sediment transported from units into fish-bearing streams when analyzing alternatives. While the increase in sediment reaching streams differs by alternative (Table 5), the effects to fish and fish habitat are the same. This is because fish habitat would be modified from the over 1100% increase in baseline sediment transported to streams (as a result of consumption by fire of ground vegetation) compared to pre-fire levels. The additional increases in sedimentation associated with harvest/fuels treatments would not have any further observable effect on fish or fish habitat.

**Table 5. Sediment Increase Compared to Pre- and Post-Fire Conditions from a Low Probability Runoff Event**

| | Alternative 1 | Alternative 2 | Alternative 3 | Alternative 4 | Alternative 5 |
|---|---|---|---|---|---|
| Compared to Pre-fire Baseline* | 1100% | 1500% | 1300% | 1100% | 1400% |
| Compared to Post-fire Existing Condition | 0% | 33% | 15% | 0% | 28% |

*Percentages rounded to hundreds

It is difficult to predict the effects on fish and fish habitat of an episodic or pulse event of this magnitude after a fire. Increases in sediment loads to streams can reduce the quality and quantity of fish habitat (Meehan 1991). However, Rieman and Clayton (1997) state that pulse disturbances from fires or floods may be necessary to maintain or create high quality fish habitat. Furthermore, redband trout and Malheur mottled sculpin have evolved with these events and are resilient to these pulse disturbances.

Overall, pool habitat quantity and quality may be reduced and stream channel width to depth ratios increased as well as spawning habitat reduced in quality and quantity in the project area. Channel degradation or "downcutting" could also occur which could disconnect floodplains from Snow Creek or Jack Creek or further disconnect the floodplain in the Silvies River. These changes would result in reductions in populations of redband trout and Malheur mottled sculpin for all alternatives.

Conversely, a sediment pulse from a 5 year or greater runoff event may create more pool habitat by backing up against in-channel LWD, build point bars and stream banks and aggrade the stream elevation in the Silvies River causing it to reconnect to the floodplain. These changes would result in improved habitat and increased populations of redband trout and Malheur mottled sculpin for all alternatives.

Projects completed or ongoing under Categorical Exclusions (listed in this document) include Coarse Woody Debris (CWD) placement and riparian hardwood planting. Activities in 2003 focused on sensitive stream reaches due to channel type such as the Silvies River and the segment of Snow Creek, which was burned with high severity. The projects were designed to make stream reaches more resilient

to negative impacts in the case of a large runoff event thereby minimizing potential to impact redband trout and Malheur mottled sculpin.

A large runoff event could also kill fish in streams by degrading water quality with high amounts of sediment. Debris torrents are unlikely in the fire area due to the low gradient landscape. A large, pulse event could kill all fish in the streams of the project area. However, there are fish outside the fire area that would likely move into Snow Creek, Jack Creek and the portion of the Silvies River in the fire area. Furthermore, pulse sediment events tend to be highly localized, and thus would not likely have the same effect to all streams or even the entire length of one stream (Rieman and Clayton 1997).

In summary, a 5-year or greater runoff event would have the same effects, whether positive or negative, on fish and fish habitat from any alternative because the magnitude of sediment transported to streams as a result of the fire. There would be no effects to fish and fish habitat from sediment in all alternatives from a 5-year or less runoff event.

**PROJECT DESCRIPTION (**Proposed Action and Alternatives Considered)
See Chapter 1 of the Flagtail Fire Restoration Project EIS for a complete description of the Project Area and Chapter 2 for the description of alternatives as well as mitigation measures.

**Effects and Determination**

The following is a site-specific analysis of the potential effects on redband trout and Malheur mottled sculpin for all alternatives. The potential direct and indirect effects of the project have been evaluated for the following parameters: water quality (temperature, sediment, chemical contaminants), habitat access (physical barriers), fish habitat elements (substrate embeddedness, Large Woody Debris, pool frequency and quality, large pools), channel condition and dynamics (width to depth ratio, stream bank condition, floodplain connectivity), flow/hydrology (change in peak/base flows), drainage network, watershed conditions (road density and location, disturbance history).

Cumulative effects of all past, present and foreseeable future actions listed in the Flagtail FEIS Appendix J were analyzed in conjunction with direct and indirect effects of project activities to determine cumulative effects on fish and fish habitat in project area streams and downstream in the Silvies River and Jack Creek. Effects of the fire and past actions were described in the existing condition portion of the Fisheries Section.

Determinations and rationale for "effects calls" for redband trout and Malheur mottled sculpin are stated after cumulative effects for each alternative.

**Alternative 1, No Action**
In order to compare this alternative to the other alternatives, it is necessary to identify some of the actions that will not occur under this alternative. No vegetative treatments would occur. There would be no road management activities other than routine road maintenance, which is an ongoing program.

**Direct and Indirect Effects**
Future fuel loading in excess of the historic range of variability would occur on 4765 acres (see Figure 17 in Map section of the Flagtail FEIS for spatial distribution). Untreated, post-fire fuel loadings would prohibit the use of fire as a management tool in later management actions to move the landscape and RHCAs toward the desired condition for vegetation and plant communities in the project area. This could again lead to fuel loading which caused the high fire severity as it related to vegetation in upland areas in the Flagtail fire area.

## Water Quality

**Temperature**: Water temperatures would likely increase during summer, base flow periods because conifers were burned that previously provided shade for streams. However, removal of the conifer overstory as a result of the fire is expected to promote riparian hardwood vegetation which would reduce stream temperatures over the next 5-7 years. Road maintenance activities located within RHCAs would not reduce existing canopy cover sufficiently to adversely affect streamside shading or water temperature.

**Sediment:** Road management activities have the highest potential for affecting sediment input to streams. "Roads modify natural drainage networks and accelerate erosional processes. These changes can alter physical processes in streams leading to changes in stream flow regimes, sediment transport and storage, channel bank and bed configurations, substrate composition, and the stability of adjacent slopes," (Furniss et al. 1991). Road related impacts most likely to contribute high sediment inputs would be plugged culverts leading to washed out road fills, undersized culverts at stream crossings leading to high water velocities and subsequent erosion at culvert outlets, or sediment channeled on road surfaces/drainage structures and routed to streams. Adverse effects from roads can be reduced by observing best management practices (BMP's), performing regularly scheduled maintenance, designing and locating roads properly, using the appropriate type of structure and size on crossings, and by avoiding critical or sensitive sites.

Mitigation measures of deferring in-channel road maintenance activities in fish bearing or perennial streams until after July 15th would allow redband trout alevin time to emerge from the gravels and become mobile. Stream flows after mid July would have dropped to base levels. Operating in the dry season reduces the risk of storm related overland surface runoff. The soils within the project area are highly permeable and have rapid infiltration rates. Under dry conditions they tend to absorb rather than shed moisture. The annual precipitation in the area is less than 25 inches per year and occurs mostly as snow during the winter. Dry season thunderstorms occasionally produce more than ½ an inch of rainfall in this area, but mitigation measures would be adequate to contain effects of a 25-year event; further activities would be postponed until flows receded to reduce potential impacts.

Ground disturbance can increase sediment, which may in turn reduce pool volume, increase cobble embeddedness, and increase turbidity that may lead to increased water temperature (Meehan 1991). This alternative would create some sediment during and after implementation of regularly scheduled maintenance activities. Regularly scheduled maintenance actions such as culvert cleaning or road grading within 50 feet of streams could transport sediment into project area streams. However, with implementation of mitigation measures, which are considered highly effective, the short-term increase would not be measurable in the stream. At current and expected future funding levels, sufficient maintenance would not be accomplished to minimize chronic sediment input to streams in the fire area. Current degraded baseline conditions would be maintained for this indicator.

**Chemical Contaminations/Nutrients**: Equipment diesel, gas, and oil lubricant are the only chemical (fuel) grouping that would be found within the project area. All three of these items have the potential to impact redband trout and Malheur mottled sculpin, if allowed to enter project area streams. Only road maintenance activities would occur within RHCAs. Most of the work would employ the use of machinery and trucks to grade roads and clean culvert inlet/outlets. Malheur National Forest safety measures relative to the use, storage, and handling of these petroleum products would be adhered too. Fuels and lubricants would not be stored in RHCAs. Traffic accidents with fuel spills are a potential risk with increased truck rock hauling. Traffic control flagging, signing, and having absorbent pads available on site would help to control the risk and facilitate immediate action, should a spill occur. The

Malheur Forest has a spill plan in place for emergencies. The small amount of activities completed, as part of regular road maintenance would further minimize potential for impacts. This alternative would not impact this indicator.

**Habitat Access**

**Physical Barriers**: No physical barriers from road/stream crossings limiting redband trout or Malheur mottled sculpin movement would be created or removed as a result of this alternative. There would be no effect to this indicator.

**Habitat Elements**

**Substrate Embeddedness**: Substrate embeddedness is a direct effect of sediment loading. See the sediment section above. Stream channel substrate in the project area is composed mainly of small diameter parent materials such as sand. A better indicator of changes in sediment loading is pools per mile or width to depth ratio because of the small parent material. There would be no effects from road maintenance with this alternative. The current conditions will be maintained.

**Large Woody Debris (LWD):** The Flagtail fire created many snags that will be available for recruitment into project area streams in the future. Smaller diameter trees are expected to begin to fall within 1-2 years with larger snags beginning to fall within 5-7 years. No LWD would be removed from RHCAs as part of this project. Hazard trees cut in RHCAs would be felled and left on site but would be available for use in CEs (listed in the section titled Information Important to this Analysis) if amounts in excess needed to avoid sedimentation or necessary to meet LRMP standards exist in the specific stream reach of the project area. If LWD is located immediately upstream of a road crossing, it may be transported to the stream channel or riparian area below if there is the potential for damage or blocking of the stream crossing structure. Without timber harvest and fuels reduction projects, high severity wildfire could occur in the future before conifers could grow to sufficient size for recruitment of LWD. This alternative would have no effect on this indicator in the short-term and potentially an adverse effect in the long-term.

**Pool Frequency and Quality:** The quality and quantity of pools in a system are affected largely by substrate size and movement; LWD amounts; peak flow events (water yield); and the amount of sediment loading in the stream system (see sections above). Pools can be lost or their biologic function impaired by floods; moving bedload material around and aggregating up the substrate level, moving instream LWD that can catch and create a debris jam, which then changes the flow hydraulics allowing deposition, creating complete channel shifts that then turn primary channels into secondary side channels, or by eroding banks and floodplain deposits increasing sediment loading into the system. The potential to reduce pool frequency and quality is minimal based on high probability runoff events; this alternative would have no effect on this indicator, maintaining the current conditions of reduced pool frequency and quality. The effects of a low probability, large runoff event are difficult to predict and could increase or decrease pool frequency and quality in project area streams.

**Large Pools**: The Silvies River is the only stream in the project area of sufficient size to contain large pools (greater than 3 feet deep). The potential to affect pool structure is similar for large pools (see the previous discussion on pool frequency and quality). Road maintenance activities are expected to maintain the current conditions.

**Off Channel Habitat:** The potential for off-channel habitat along the small streams in the project area is quite limited. The Silvies River has the potential to provide some off channel habitat in the form of

side channels or small alcoves. Road maintenance activities would not impact the floodplain of project area streams backwater areas. Implementation of this alternative is expected to maintain the current conditions.

**Refugia**: None of the proposed actions have the potential to affect this baseline condition.

### Channel Condition and Dynamics

**Wetted Width/Maximum Depth Ratio:** Regularly scheduled road maintenance activities would occur within RHCAs. Roads and culverts currently impacting streams would continue to do so. Overall, there would no effect to this indicator. Current degraded conditions would be maintained with alternative.

**Stream Bank Condition**: See above sections on sediment and wetted width/maximum depth ratio. Limited road maintenance may have small impacts on stream bank condition at stream road crossing work site locations. Streambanks immediately downstream of culverts impacting stream banks would continue to be impacted from water velocities at peak and near peak flows. This would maintain the current condition.

**Floodplain Connectivity**: The road system would remain as it is. Roads impacting floodplain connectivity would continue to impact this indicator. This would maintain the current condition.

### Hydrology/Flow

**Change in Peak/Base Flows**: Road systems affect peak flows by extending the drainage network (see below) and increasing delivery efficiency to the stream channel. As described below, this alternative will not change peak flows from the existing condition. The effects of road maintenance activities in this alternative on peak/base flows would maintain current conditions.

**Drainage Network Increase:** Roads and road management activities have the greatest potential to affect the drainage network. Road maintenance will result in a reduction of the drainage network by dispersing runoff from the road surface and reducing the channeling of water in ephemeral draws. However, the limited amount of regularly scheduled road maintenance would not keep up with impacts on the landscape from the existing road system. This alternative is expected to maintain the baseline condition in the short-term, and potentially increase the drainage network in the long-term.

### Watershed Conditions

**Road Density and Location**: Stronghold populations of salmonids are associated with higher-elevation forested lands and the proportion declines with increasing road densities (Quigley et al. 1996). The higher the road density, the lower the proportion of subwatersheds that support strong populations of key salmonids. Specifically, the Quigley document shows a strong correlation with road densities of 2 miles/mile$^2$ or higher and reduction of strong populations of salmonids. Further reductions of strong salmonid populations were identified at densities of 3 miles/mile$^2$ and 4 miles/mile$^2$ or greater. Roads in the project area that occur within 100 feet of streams or cross streams commonly impact fish and fish habitat more than roads located in uplands.

**Table 6. Road Information for Alternative 1**

| | Project Area | | | Entire Subwatershed (Public & Private) | | | |
|---|---|---|---|---|---|---|---|
| Subwatershed (SWS) | Total Road Miles | Road Miles within | Stream Crossings on Roads | Total Road Miles | Road Miles within | Stream Crossings on Roads | Total Road Density Mi/ Mi$^2$ |

| | | **100 ft. of Cat. 1-4 Channels** | | | **100 ft. of Cat. 1-4 Channels** | | |
|---|---|---|---|---|---|---|---|
| Hog* | 1.2 | 0.1 | 0 | 55.0 | 8.3 | 73 | 5.8 |
| Jack | 23.0 | 2.9 | 19 | 49.3 | 5.1 | 50 | 3.1 |
| Keller | 2.4 | 0.1 | 1 | 44.4 | 6.7 | 73 | 3.8 |
| Snow* | 25.0 | 5.9 | 22 | 35.1 | 7.4 | 36 | 3.5 |
| Total | 51.6 | 9.1 | 42 | 183.8 | 27.5 | 232 | NA |

*Not true subwatersheds; Snow Creek and Hog Creek SWS include the Silvies River

Road densities would remain at or above 3 miles/mile$^2$ in all subwatersheds and miles within 100 feet of Category 1-4 channels would remain high (Table 6). There are over 9 miles of roads (see Table 6) that likely impact streams due to proximity (100 feet or less). This alternative would not change road densities or location in the project area. Road densities and roads in close proximity to streams would remain at detrimental levels in all subwatersheds. This would maintain the baseline condition.

**Disturbance History**: The proposed action would have a limited effect on features of the disturbance history within this watershed. As a result of historic activities in the area, several watershed conditions have been modified. Road maintenance activities would have the net result of maintaining effects of the existing road system. This indicator would be maintained with implementation of these activities.

**Riparian Conservation Areas**: The Upper Silvies Watershed is covered by the INFISH riparian conservation strategy. The Road maintenance actions follow the standards and guidelines in INFISH. The current condition would be maintained with the implementation of these activities.

**Summary of Direct and Indirect Effects for Fish**

Effects on fish from the Flagtail fire include indirect effects from changes in habitat initiated by the fire. These effects are described above in this section. In summary, there are no effects expected on fish habitat complexity or quality from increases in water yield compared to baseline conditions before the fire. There are no effects expected on fish habitat complexity or quality from increases in sediment associated with a high probability runoff event compared to baseline conditions before the fire. The effects of a low probability, large runoff event are difficult to predict and could degrade or improve fish habitat. Instream large woody debris would increase as snags fall into streams. Short-term effects of the fire reducing conifer overstory would increase summer water temperatures, but would probably not significantly impact fish, whereas long-term effects of the fire rejuvenating riparian hardwood vegetation would either be insignificant or possibly beneficial (except for the potential for future fires of high intensity due to fuel loading).

Regularly scheduled road maintenance activities would not create measurable impacts from sediment during implementation and would have long-term benefits to fish habitat and populations. However, current and future funding levels for road maintenance are inadequate to reduce chronic sediment input to streams in the project area. Chemical contamination is also possible but unlikely because Malheur National Forest safety measures, considered highly effective, would be followed relative to the use, storage, and handling of petroleum products.

***Cumulative Effects***

Cumulative effects of projects completed as CEs are as follows:

1. Large and coarse woody debris placed in ephemeral draws as well as Category 1, 2 and 4 channels would capture sediment in all channels and (Category 1 and 2 channels) create and maintain pools

and improve channel width to depth ratios to better maintain stream temperatures in project area streams and downstream in the Silvies River system. This project was begun in 2003 by placement on 1.5 miles in the Silvies River and 1 mile in the high severity burn portion of Snow Creek as well as several ephemeral draws and will continue in 2004. Woody debris placement is designed to make streams more resilient to the effects of a large runoff event, reducing the potential to degrade fish habitat and impact fish in project area streams or downstream of the project area. Woody debris placed below the stream crossing at Road 2400-133 on Snow Creek and below the stream crossing at Road 24 on Jack Creek will improve fish passage (habitat connectivity) by reducing the jump height at the culvert outlets during low flow conditions thereby making summer rearing habitat more accessible. Materials may be obtained outside RHCAs or inside RHCAs after adequate amounts of woody debris are left in RHCAs to capture sediment.

**2.** Stream ecosystem recovery is dependent on riparian vegetation and floodplain conditions (Minshall in press). Riparian hardwood planting and protection in Category 1-2 streams, the majority completed in 2003 and the remainder planned for 2004 would start to improve channel width to depth ratios by root strength (within 3-5 years) and provide shade to better maintain stream temperatures (within 7-10 years) in Snow Creek, the Silvies River and Jack Creek as well as downstream in the Silvies River system. These plants may later become parts of aggregates of woody debris creating pools and capturing sediment. Riparian hardwoods also provide habitat and food for macroinvertebrates after 4-5 years. These macroinvertebrates could then be food for fish.

**3.** Riparian and upland conifer planting would provide shade and potential large wood for recruitment into project area streams.

4. A fuels reduction project to reduce fuel levels to within the historic range of variability will occur inside RHCAs where dead, submerchantable trees under 8-inch DBH would be thinned, then hand piled and burned outside of riparian areas (if not needed to capture sediment in the RHCA or use in the CWD placement CE) would reduce severity of future wildfires inside RHCAs thus reducing potential mortality to riparian vegetation and effects to streams.

No grazing on pastures in the fire area for a minimum of 2 growing season as directed by a Malheur Nation Forest guideline would reduce cumulative effects of wild and domestic ungulate browsing and grazing pressure to allow hardwoods to re-establish and herbaceous vegetation to recover in riparian areas. The effects would be similar and additive to hardwood planting and protection.

Legacy impacts from roads, harvest and grazing activities on private and public land have reduced fish habitat quality and complexity in project area streams and downstream in the Silvies River. Riparian vegetation has been reduced and width to depth ratios are high resulting in excessive summer rearing temperatures. This has reduced fish populations of redband trout in all fish bearing streams and Malheur mottled sculpin in the Silvies River and Hog Creek compared to natural conditions.

However, actions associated with CEs are expected to improve aquatic conditions compared to the existing condition thereby improving fish populations. Bankfull and wetted width to depth ratios should decrease in all streams, potentially modifying Rosgen channel types in the Silvies River from "Bc" to "C" or "E" types and reconnecting the floodplain. Redband (in all streams) and Malheur mottled sculpin (in the Silvies River) populations should improve and expand with better summer and winter rearing as well as spawning habitat due to lower sediment loads, more pools and lower summer water temperatures.

**Effects Determination and Rationale**

Fuel loading will increase in the project area as snags fall and new vegetation grows. Fuel loading would exceed the natural range of variability on 4765 acres in the fire area in 20 years. This could lead to high severity wildfire that has the potential to impact fish and fish habitat in the project area.

The activities with the highest potential for affecting sediment input to streams are road management activities. Under this alternative, there would be no road management activities other than ongoing routine road maintenance, which is inadequate to maintain the road system. This can be considered no change from the existing condition. This alternative would do nothing to reduce impacts of the existing road system, specifically road density and location. It would be expected that sedimentation from existing roads would increase over time, unless other projects are implemented to address these impacts.

This alternative **May Impact Individuals or Habitat** (**MIIH**) by maintaining degraded conditions in Jack Creek, Snow Creek and the Silvies River. These impacts would not cover a large enough area to reduce population viability and result in a **WIFV** determination for redband trout or Malheur mottled sculpin.

**Alternative 2, Proposed Action**
**Direct and Indirect Effects**
Harvest and fuels treatments would reduce fuel loading from excess of the historic range of variability on 4245 acres; fuel loading would remain in excess of the historic range of variability on 520 acres (see Figure 18 in Map section for spatial distribution, see Fuels section of FEIS for further details). Areas with fuel loading in excess of the historic range of variability reduce the ability to use prescribed burning as a management tool in uplands and riparian areas in future management actions to move toward desired conditions and could lead to high severity wildfire.

**Water Quality**

**Temperature**: Water temperatures would likely increase during summer, base flow periods because conifers were burned that previously provided shade for streams. However, removal of the conifer overstory as a result of the fire is expected to promote riparian hardwood vegetation reducing stream temperatures over the next 5-7 years. Felling of hazard trees on roads in the project area is not expected to modify stream temperatures. There would be no harvest or fuels treatment activities inside default INFISH RHCAs (see cumulative effects for effects of other activities in RHCAs in the project area) with this project. Road management activities such as maintenance and reconstruction located within RHCAs would not reduce existing canopy cover sufficiently to modify streamside shading or water temperature. Road decommissioning activities near streams or at crossings would allow riparian hardwood vegetation to increase shade to streams, thereby reducing stream temperatures during base flows over time.

**Sediment:** No timber harvest or fuels management activities are proposed within RHCAs with this project (see cumulative effects for effects of other activities in RHCAs in the project area). The use of default INFISH buffers on Category 1-4 stream channels as well as creation of buffers and designated skid trail crossings on ephemeral draws would be highly effective at protecting streams and fish from impacts of harvest or fuels reduction activities. Subsoiling is expected to decompact soils, improving site productivity for vegetation, improving infiltration rates, and reducing potential for sediment transport or erosion. Harvest and fuels treatments are not expected to create or transport sediment outside of the harvest unit or cause erosion problems due to limited sediment transport capabilities in the landscape (see sediment transport and WEPP modeling sections above) as the result of a high probability runoff event. A low probability, large runoff event would transport sediment to streams, but effects would not be measurably different than from sediment transport without harvest or fuels treatments (based on WEPP modeling).

The activities with the highest potential for affecting sediment input to streams are road management activities. "Roads modify natural drainage networks and accelerate erosional processes. These changes

can alter physical processes in streams leading to changes in stream flow regimes, sediment transport and storage, channel bank and bed configurations, substrate composition, and the stability of adjacent slopes" (Furniss et al. 1991). Road related impacts most likely to contribute high sediment inputs would be plugged culverts leading to washed out road fills, undersized culverts at stream crossings leading to high water velocities and subsequent erosion at culvert outlets, or sediment channeled on road surfaces/drainage structures and routed to streams. Adverse affects from roads can be reduced by observing best management practices (BMPs), performing regularly scheduled maintenance, designing and locating roads properly, using the appropriate type of structure and size on crossings, and by avoiding critical or sensitive sites.

Mitigation measures of deferring road management activities in channels of fish bearing or perennial streams until after July 15th would allow redband trout alevin time to emerge from the gravels and become mobile before any sediment was mobilized. This deferral would also allow fish moving into Snow Creek from the Silvies River (likely occurring from May through mid-June to reach summer rearing habitat before culvert replacement on Snow Creek associated with reconstruction would temporarily block passage. Stream flows after mid July would have dropped to base levels. Operating in the dry season reduces the risk of storm related overland surface runoff. The soils within the project area are highly permeable and have rapid infiltration rates. Under dry conditions they tend to absorb rather than shed moisture. The annual precipitation in the area is less than 25 inches per year and occurs mostly as snow during the winter. Dry season thunderstorms occasionally produce more than ½ an inch of rainfall in this area, but design criteria would be adequate to contain effects of a 25-year event and activities would be postponed until flows receded to reduce potential impacts.

Proposed road management actions such as culvert replacement or cleaning at stream crossings, or road decommission, reconstruction, maintenance within 100 feet (GIS mapped) of streams would produce short-term (1-2 years) sediment into project area streams. Rocking over disturbed soils would help in protecting soil particle displacement in turn reducing sedimentation risks. Inlet and outlet collars would be rocked where needed. Fill slopes would be straw mulched and grass seeded as needed. These activities would put some sediment directly into project area streams.

There would be no effect from the permanent road construction in Snow Creek Subwatershed due to the location outside of the RHCA. Construction and decommission of temporary roads is not expected to have any effect on fish or fish habitat due to their location outside RHCAs (most on or near ridgetops) on low gradient slopes.

Ground disturbance can increase sediment which may in turn reduce pool volume, increase cobble embeddedness, and increase turbidity that may lead to increased water temperature (Meehan 1991). This project would produce some short-term sediment during and after implementation in order to reduce long-term direct and indirect sediment inputs. The short-term increase would be very small in size and scale due to the small area of disturbance at each project point. No measurable short-term impacts are expected outside the work location. Benefits of the project include: reduced surface erosion; improved drainage functionality; reduced long-term risk of a large-scale road culvert failure; improved fish habitat and passage; reduced maintenance costs. Long-term effects would be beneficial with the elimination of current sediment inputs caused by undersized or plugged culverts and poor drainage features.

**Chemical Contaminations/Nutrients**: Lignin sulfonate, or magnesium chloride may be used for dust abatement on roads (25 feet or further from fish bearing or perennial streams), as needed, during periods of heavier vehicle use associated with commercial timber harvest activities. “Based on the literature

review and typical application rates for dust abatement, the effects of these compounds on plants and animals would likely be negligible" (Heffner 1992).

Equipment diesel, helicopter fuel, gas, oil lubricant and hydraulic fluids are the fuel groupings that would be found within the project area. All of these items have the potential to adversely affect redband trout and Malheur mottled sculpin, if allowed to enter project area streams. Only road management activities would occur within RHCAs. Most of the work would employ the use of machinery and trucks to dig or pick up, as well as, move in or remove rock and soil material. Malheur National Forest safety measures relative to the use, storage, and handling of these petroleum products, which are considered highly effective, would be adhered too. Fuels and lubricants would not be stored in RHCAs. Traffic accidents with fuel spills are a potential risk with increased truck rock hauling. Temporary road closures are planned during culvert replacement. Traffic control flagging, signing, and having absorbent pads available on site would help to control the risk and facilitate immediate action, should a spill occur. The Malheur Forest has a spill plan in place for emergencies. This project would not impact this indicator.

**Habitat Access**

**Physical Barriers**: No new physical barriers limiting redband trout or Malheur mottled sculpin movement would be created as a result of this project. Work at culverts may cause temporary blockages during channel and bank work with the application of mitigation measures necessary to trap fine sediment. The use of straw bales, filter cloth, or sand bags or water diversion through temporary pipe or plastic-lined ditches may block individuals during project implementation. This sediment control measure would probably be used for a total of up to 2 days then removed. Timing instream work activities after July 15 on Snow Creek would ensure fish moving into this stream for summer rearing from the Silvies River would not be affected. The culvert replacement on Road 2400-133 at Snow Creek would accommodate fish passage at all flows to all life histories where a partial barrier currently exists. There would be a beneficial effect for this indicator.

**Habitat Elements**

**Substrate Embeddedness**: Substrate embeddedness is a direct effect of sediment loading. See sediment section above as proposed road management actions would directly input some sediment into project area streams. Stream channel substrate in the project area is composed mainly of small diameter parent materials such as sand. A better indicator of changes in sediment loading is pools per mile or width to depth ratio because of the small parent material. The combined effects of the proposed road management actions on sediment are expected to be a minimal short-term effect, and a beneficial long-term effect (see sediment section above). The expected minimal short-term effect on sediment would have a negligible effect, if any, on substrate embeddedness with a long term benefit by reducing chronic sediment input and hence reducing substrate embeddedness in project area streams.

**Large Woody Debris (LWD):** The Flagtail fire created many snags that will be available for recruitment into project area streams in the future. Smaller diameter trees are expected to begin to fall within 1-2 years with larger snags beginning to fall within 5-7 years. No LWD would be removed from RHCAs as part of this project (see cumulative Effects Section for effects of other actions planned or ongoing in RHCAs in the project area). Hazard trees cut in RHCAs would be felled and left on site. If LWD is located immediately upstream of a road crossing, it may be transported to the stream channel or riparian area below if there is the potential for damage or blocking of the stream crossing structure. This project would have no effect on this indicator.

**Pool Frequency and Quality:** The quality and quantity of pools in a system are affected largely by substrate size and movement; LWD amounts; peak flow events; and the amount of sediment loading in

the stream system (see sections above). Pools can be lost or their biologic function impaired by floods, moving bedload material around and aggregating up the substrate level, moving instream LWD that can catch and create a debris jam, which then changes the flow hydraulics allowing deposition, creating complete channel shifts that then turn primary channels into secondary side channels, or by eroding banks and floodplain deposits increasing sediment loading into the system. The potential to reduce pool frequency and quality is minimal based on high probability runoff events; this alternative would reduce chronic sedimentation to streams from roads thereby likely having a beneficial effect on this indicator. The effects of a low probability, large runoff event are difficult to predict. Large "pulse events" could increase or decrease pool frequency and quality in project area streams.

**Large Pools**: The Silvies River is the only stream in the project area of sufficient size to contain large pools (greater than 3 feet deep). The potential to affect pool structure is similar for large pools (see the previous discussion on pool frequency and quality). Implementation of road management activities is expected to maintain or improve large pool habitat in the Silvies River.

**Off Channel Habitat:** The potential for off-channel habitat along the small streams in the project area is quite limited. The Silvies River has the potential to provide some off channel habitat in the form of side channels or small alcoves. This project would not impact the floodplain of project area streams backwater areas. Implementation of this alternative is expected to maintain the current conditions.

**Refugia**: None of the proposed actions have the potential to affect this baseline condition.

**Channel Condition and Dynamics**

**Wetted Width/Maximum Depth Ratio:** Limited activities are proposed within RHCAs. Removal of culverts from project area stream channels as part of road decommissioning is not expected to impact this parameter in the short-term and is designed to improve these ratios in the long-term by reducing chronic sediment input from roads to streams. The culvert replacement at the live water crossing of Road 2400-133 on Snow Creek would reduce water velocity below the road during peak and near peak flow events by designing the crossing to handle 100-year flow events. Projects would incorporate expected width to depth ratios for the geomorphology of the site. Reduced water velocity at high flows would result in a reduction in the width to depth ratio immediately below the crossing. Overall, there would likely be negligible short-term impacts with long-term benefits from implementation of all road management activities.

**Stream Bank Condition**: See above sections on wetted width/maximum depth ratio and sediment. Road/stream crossing projects would have small short-term impacts on stream bank condition at project site locations during implementation. These impacts would be mitigated with riparian planting and/or culvert outlet hardening. The projects would have long-term benefits to streambanks immediately downstream of culverts because of lower water velocities at peak and near peak flows would have less energy which can reduce stream bank stability.

**Floodplain Connectivity**: No road construction or other activity is proposed that could result in disconnecting any floodplain function from the adjacent stream. The only action, which has the potential to affect floodplain connectivity, would be decommissioning about 4.3 miles of roads within 100 feet of streams. There would be no adverse short-term effects and a long-term beneficial effect on floodplain connectivity.

## Hydrology/Flow

**Change in Peak/Base Flows**: Road systems affect peak flows by extending the drainage network (see Drainage Network Increase and Road Density and Location sections) and increasing delivery efficiency to the stream channel. As described below, this alternative will not extend the drainage network and will not change peak flows from the existing condition. No effects of road management activities of this alternative on peak/base flows are expected in the short-term and designed to improve conditions in the long-term.

**Drainage Network Increase:** Road management activities the greatest potential to affect the drainage network. Road reconstruction and maintenance will result in a reduction of the drainage network by adding relief drainage structures to disperse water from the road surface and reducing the channeling of water in ephemeral draws. Decommissioning of roads in RHCAs will decrease the drainage network over time. A lesser beneficial effect will result from road closures. Implementation of this project is expected to maintain the baseline condition in the short-term, and improve the baseline in the long-term.

## Watershed Conditions

**Road Density and Location**: Stronghold populations of salmonids are associated with higher-elevation forested lands and the proportion declines with increasing road densities (Quigley et al. 1996). The higher the road density, the lower the proportion of subwatersheds that support strong populations of key salmonids. Specifically, the Quigley document shows a strong correlation with road densities of 2 miles/mile$^2$ or higher and reduction of strong populations of salmonids. Further reductions of strong salmonid populations were identified at densities of 3 miles/mile$^2$ and 4 miles/mile$^2$ or greater.

The following road activities, which modify this parameter, are proposed with this alternative: 0.3 miles construction and 13.1 miles decommission. The construction is associated with relocation of 1 mile of road impacting Snow Creek that would be decommissioned with this alternative. Road densities would be reduced below 3 miles/mile$^2$ in Jack Creek and Snow Creek subwatersheds. Decommission of 4.8 miles of roads within 100 feet (mapped GIS) of streams would be important to fisheries as these are most likely reducing fish habitat quality. The 53% decrease in the project area is a vast improvement from the existing condition. Table 7 lists road information in the project area and the entire subwatershed.

**Table 7. Road Information for Alternative 2**

| | | Project Area | | | | Entire Subwatershed (Public & Private) | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Subwatershed (SWS)** | **Temporary Road Construction/ Decommission** | **Decommission Miles** | **Total Road Miles** | **Road Miles within 100 ft. of Cat. 1-4 Channels** | **Stream Crossings on Roads** | **Total Road Miles** | **Road Miles within 100 ft. of Cat. 1-4 Channels** | **Stream Crossings on Roads** | **Total Road Density Mi/ Mi$^2$** |
| Hog* | 0.3 | 0.1 | 1.1 | 0.1 | 0 | 54.9 | 8.3 | 73 | 5.8 |
| Jack | 0.3 | 7.1 | 16.3 | 1.4 | 11 | 42.3 | 3.6 | 41 | 2.7 |
| Keller | 0.3 | 0 | 2.4 | 0.1 | 1 | 44.4 | 6.7 | 73 | 3.8 |
| Snow* | 3.0 | 5.9 | 19.7 | 3.2 | 12 | 29.5 | 4.6 | 25 | 2.9 |
| Total | 3.9 | 13.1 | 39.5 | 4.8 | 24 | 171.1 | 23.2 | 212 | NA |

*Not true subwatersheds; Snow Creek and Hog Creek SWS include portions of the Silvies River

**Disturbance History**: The proposed action would have a limited effect on features of the disturbance history within this watershed. As a result of historic activities in the area, several watershed conditions have been modified. Road management activities, particularly decommission, would have the net result

of reducing the effects of the existing road system. This indicator would be maintained with implementation of these activities.

**Riparian Conservation Areas**: The Upper Silvies Watershed is covered by the INFISH riparian conservation strategy. The proposed actions follow the standards and guidelines in INFISH. The current condition would be maintained with the implementation of these activities.

**Alternative 2 Summary of Direct and Indirect Effects for Fish**

Effects on fish from the Flagtail fire include indirect effects from changes in habitat initiated by the fire and those of management activities. These effects are described above. In summary, there are no effects expected on fish habitat complexity or quality from increases in water yield compared to baseline conditions before the fire individually from the fire or harvest/fuels management activities. There are no effects of sediment compared to post-fire conditions from harvest/fuels management activities. Valley bottoms are low gradient as are side hill slopes and riparian areas on perennial and fish bearing portions of streams were relatively unburned allowing for filtration of sediment. Water yield is not expected to increase at the subwatershed scale as a result of the fire or harvest activities as only dead and dying trees would be removed. Default INFISH no-harvest buffers would be used associated with harvest/fuels management activities. In addition, no-harvest buffers and designated skid trail crossings would be created on ephemeral draws to mitigate potential sedimentation/erosion.

Road management activities have the greatest potential for short-term localized impacts from sediment and long-term benefits to fish and fish habitat. Chemical contamination is also possible but unlikely because Malheur National Forest safety measures, considered highly effective, would be followed relative to the use, storage, and handling of petroleum products. Decommission of roads within 100 feet of streams is a benefit for fish and fish habitat in the project area. Harvest and fuels treatment activities are not expected to have any impacts to fish and fish habitat. Short-term effects of the fire reducing conifer overstory would increase summer water temperatures and would be adverse, but would probably not significantly affect fish, whereas long-term effects of the fire would either be insignificant or possibly beneficial with the addition of large wood to stream channels and draws provided by snags created in the fire.

**Cumulative Effects**

Legacy impacts from roads, harvest and grazing activities on private and public land have reduced fish habitat quality and complexity in project area streams and downstream in the Silvies River. Riparian vegetation has been reduced and width to depth ratios are high resulting in excessive summer rearing temperatures. This has reduced fish populations of redband trout in all fish bearing streams and Malheur mottled sculpin in the Silvies River and Hog Creek compared to natural conditions.

Cumulative effects would be similar to the No Action alternative due to actions completed under CEs. Actions associated with CEs are expected to improve aquatic conditions compared to the existing condition thereby improving fish populations (see Alternative 1 Cumulative Effects section—Cumulative effects of projects completed as CEs). Bankfull and wetted width to depth ratios should decrease in all streams and potentially modifying Rosgen channel types in the Silvies River from "Bc" to "C" or "E" types and reconnecting the floodplain. Redband (in all streams) and Malheur mottled sculpin (in the Silvies River) populations should improve and expand with better summer and winter rearing as well as spawning habitat due to lower sediment loads, more pools and lower summer water temperatures.

The road management activities associated with the action alternatives are expected to have long-term benefits that would improve habitat complexity and fish populations more than the No Action alternative, likely improving conditions beyond the pre-fire baseline. The short-term impacts of sediment from road management activities are expected to have a negligible effect to fish habitat or populations.

**Effects Determination and Rationale**

The activities with the highest potential for affecting sediment input to streams are road management activities. Under this alternative, there would be road management activities which include construction/relocation of system roads, maintenance (including creation of additional relief drainage structures), reconstruction (culvert replacement on Snow Creek), decommission of existing system roads and construction/decommission of temp roads. The only measurable short-term impacts on fish or fish habitat would be those from reconstruction or decommission activities within 100 feet (mapped GIS) of streams. The impacts would be limited to the immediate vicinity of the activity. However, the long-term reduced impacts to aquatic indicators would result in a **Beneficial Impact** (**BI**) for redband trout and Malheur mottled sculpin.

Fuel loading would be reduced as a result activities associated with this alternative and a fuel treatment project in RHCAs implemented under a CE. This could lead to reduced impacts (severity) of future wildfire that has the potential to impact fish and fish habitat in the project area. Fuel loading will increase in the project area as snags fall and new vegetation grows. Fuel loading would exceed the natural range of variability on 520 acres in the fire area in 20 years. This could lead to high severity wildfire in some areas that has the potential to impact fish and fish habitat in the project area.

In summary, this alternative **May impact individuals or habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to the population or species** (**MIIH**) in the short-term due to road management activities. However, the long-term reduced impacts to aquatic indicators (due to road management activities) would result in a **Beneficial Impact** (**BI**) for redband trout and Malheur mottled sculpin.

**Alternative 3**
**Direct and Indirect Effects**

Effects are very similar to alternative 2. To reduce redundancy, only differences in Direct and Indirect effects from Alternative 2 will be discussed for this alternative.

Harvest and fuels treatments would reduce fuel loading from excess of the historic range of variability on 2342 acres; fuel loading would remain in excess of the historic range of variability on 2423 acres (see Figure 19 in Map section of Flagtail FEIS for spatial distribution). Areas with fuel loading in excess of the historic range of variability reduce the ability to use prescribed burning as a management tool in uplands and riparian areas in future management actions to move toward desired conditions and could lead to high severity wildfire.

Road activities are the same as in alternative 2 (Table 7) except for 1 mile of temporary road in Snow Creek subwatershed that would not be built in Alternative 3. The location of this road high in subwatershed makes overall effects the same as Alternative 2. Therefore direct and indirect effects of road activities are expected to be the same as Alternative 2.

**Cumulative Effects**
Cumulative effects would be the same as those listed for Alternative 2. This is because effects of the road management activities are the same and the effects of actions completed under CEs.

**Effects Determination and Rationale**
Cumulative effects are very similar to alternative 2. The main difference is from higher fuel loading after implementation of harvest and fuels treatment activities. The determination for redband trout and Malheur mottled sculpin are the same.

In summary, this alternative **May impact individuals or habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to the population or species** (**MIIH**) in the short-term due to road management activities. However, the long-term reduced impacts to aquatic indicators (due to road management activities) would result in a **Beneficial Impact** (**BI**) for redband trout and Malheur mottled sculpin.

**Alternative 4**
**Direct and Indirect Effects**

Effects are very similar to alternative 2. To reduce redundancy, only differences in effects from Alternative 2 will be discussed for this alternative.

Fuels treatments would reduce fuel loading from excess of the historic range of variability on 405 acres; fuel loading would remain in excess of the historic range of variability on 4360 acres (see Figure 20 in Map section of Flagtail FEIS for spatial distribution). Areas with fuel loading in excess of the historic range of variability reduce the ability to use prescribed burning as a management tool in uplands and riparian areas in future management actions to move toward desired conditions and could lead to high severity wildfire.

Road activity would be similar to the other action alternatives except that no construction (relocation), reconstruction, or temporary road construction/decommission would occur. One mile of decommission activities associated with road relocation in the riparian area of Snow Creek would not be completed. Another significant difference is that road maintenance activities would occur only at regularly scheduled intervals, which at current and expected future funding levels, would not allow accomplishment of all maintenance needed to reduce chronic sediment input to streams. Road density and location are similar in this alternative compared to Alternative 2 but less decommissioning activities are planned in the Snow Creek subwatershed. Table 8 lists information by subwatershed. This would reduce short-term impacts and long-term benefits regarding sediment, drainage network, peak/base flows proportionate to the reduced level of activities.

**Table 8. Road Information for Alternative 4**

| | Project Area | | | | Entire Subwatershed (Public & Private) | | | |
|---|---|---|---|---|---|---|---|---|
| **Subwatershed (SWS)** | **Decommission Miles** | **Total Road Miles** | **Road Miles within 100 ft. of Cat. 1-4 Channels** | **Stream Crossings on Roads** | **Total Road Miles** | **Road Miles within 100 ft. of Cat. 1-4 Channels** | **Stream Crossings on Roads** | **Total Road Density Mi/ $Mi^2$** |
| Hog* | 0.1 | 1.1 | 0.1 | 0 | 54.9 | 8.3 | 73 | 5.8 |
| Jack | 7.1 | 16.3 | 1.4 | 11 | 42.3 | 3.6 | 41 | 2.7 |
| Keller | 0 | 2.4 | 0.1 | 1 | 44.4 | 6.7 | 73 | 3.8 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Snow* | 4.7 | 20.5 | 4.0 | 13 | 30.4 | 5.4 | 26 | 3.0 |
| Total | 11.9 | 40.3 | 5.6 | 25 | 172 | 24.0 | 213 | NA |

*Not true subwatersheds; Snow Creek and Hog Creek SWS include portions of the Silvies River

**Cumulative Effects**

Cumulative effects for Alternative 4 would be similar to those for Alternatives 2, 3 and 5 due to management actions completed under CEs and road management activities. The main difference is the reduction in road maintenance and decommission activities and heavier future fuel loading after management actions and the greater potential for high severity wildfire in the future. Cumulative effects are expected to have long-term benefits that will improve habitat complexity and fish populations, likely improving conditions beyond the pre-fire baseline. The short-term impacts of sediment from road management activities are expected to have a negligible effect to fish habitat or populations.

**Effects Determination and Rationale**

Cumulative effects are very similar to Alternative 2. The main differences are from the reduction in road maintenance/decommission activities and higher future fuel loading with no commercial harvest. The determination for redband trout and Malheur mottled sculpin is the same.

In summary, this alternative **May impact individuals or habitat**, **but would not likely contribute to a trend towards Federal listing or loss of viability to the population or species (MIIH)** in the short-term due to road management activities. However, the long-term reduced impacts to aquatic indicators (also due to road management activities) would result in a **Beneficial Impact** (**BI**) for redband trout and Malheur mottled sculpin.

**Alternative 5**
**Direct and Indirect Effects**

Effects are very similar to alternative 2. To reduce redundancy, only differences in Direct and Indirect effects from Alternative 2 will be discussed for this alternative.

Harvest and fuels treatments would reduce fuel loading from excess of the historic range of variability on 2707 acres; fuel loading would remain in excess of the historic range of variability on 2058 acres (see Figure 21 in Map section of Flagtail FEIS for spatial distribution). Areas with fuel loading in excess of the historic range of variability reduce the ability to use prescribed burning as a management tool in uplands and riparian areas in future management actions to move toward desired conditions and could lead to high severity wildfire.

Road activities are the same as in alternative 2 (Table 7) except for 1.0 miles of temporary road in Snow Creek subwatershed that would not be built in Alternative 5. The location of this road high in subwatershed makes overall effects the same as alternative 2 and 3. Therefore direct and indirect effects of road activities are expected to be the same.

**Cumulative Effects**
Cumulative effects would be very similar as those listed for Alternatives 2, 3 and 4. This is because effects of the road management activities are the same and the effects of actions completed under CEs.

### Effects Determination and Rationale

Cumulative effects are very similar to Alternatives 2. The main difference is from higher fuel loading after implementation of harvest and fuels treatment activities. The determination for redband trout and Malheur mottled sculpin is the same.

In summary, this alternative **May impact individuals or habitat, but would not likely contribute to a trend towards Federal listing or loss of viability to the population or species** (**MIIH**) in the short-term due to road management activities. However, the long-term reduced impacts to aquatic indicators (due to road management activities) would result in a **Beneficial Impact** (**BI**) for redband trout and Malheur mottled sculpin.

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